Dr. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRAPATI SAMBHAJINAGAR.

CIRCULAR NO.SU/ Sci./College/NEP-2020/104/2024

It is hereby inform to all concerned that, In continuation circular No.SU./Revised B.Sc./NEP/72/2024/25588-96 dated 29.04.2024, the revised syllabi prepared by the Board of Studies/Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technolgy, the Academic Council at its meeting held on 08 April 2024 has accepted **the following Revised B.Sc. Course Structure & Curriculum** as per direction by the State Government dated on 13 March 2024 under the Faculty of Science & Technology (as per National Education Policy – 2020) run at the Affiliated Colleges, Dr.Babasaheb Ambedkar Marathwada University as appended herewith.

Sr.No.	Courses	Semester
1	Physics	Ist and IInd semester
2	Instrumentation Practice	Ist and IInd semester
3	Electronics	Ist and IInd semester
4	Mathematics	Ist and IInd semester
5	Industrial Chemistry	Ist and IInd semester
6	Agrochemical Fertilizer	Ist and IInd semester
7	Horticulture	Ist and IInd semester
8	Biochemistry	Ist and IInd semester
9	Botany	Ist and IInd semester
10	Zoology	Ist and IInd semester
11	Biotechnology	Ist and IInd semester
12	bioinformatics	Ist and IInd semester
13	Microbiology	Ist and IInd semester
14	Dairy Science & TEchnology	Ist and IInd semester
15	Statistics	Ist and IInd semester
16	computer Science	Ist and IInd semester
17	Geology	Ist and IInd semester
18	Chemistry	Ist and IInd semester
19	Analytical Chemistry	Ist and IInd semester
20.	Polymer Chemistry	Ist and IInd semester
21.	Environmental Science	Ist and IInd semester
22.	Fishery Science	Ist and IInd semester

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This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajinagar
-431 004.
REF.NO. SU/SCI./2024/27128-35
Date:-27.05.2024.

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Deputy Registrar,
Academic Section.

Copy forwarded with compliments to :-

1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajinagar.

2] The Section Officer,[B.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajinagar.

3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

4] The Programmer [Computer Unit-2] Examinations, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajinagar.

5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University,Chhatrapati Sambhajinagar.

6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

Dr. Babasaheb Ambedkar Marathwada University

Chhatrapati Sambhajinagar- 431001

B.Sc. Degree Programme

(Three Year / Four Years (Hons) /Four Years (Hons with Research)

Course Structure and Syllabus for B. Sc. 1st Year

(Revised)

(AS PER NEP-2020)

Subject (Major): Biotechnology

Effective from 2024-25

M.S. Patil

PREFACE

As we stand on the threshold of a new era in education, the dawn of the National Education Policy 2020 illuminates our path toward a holistic, inclusive, and progressive educational landscape. The Bachelor of Science (B. Sc.) curriculum outlined herein reflects the ethos and aspirations of this transformative policy, aiming to equip learners with the knowledge, skills, and values necessary to thrive in the dynamic world of the 21st century.

At its core, the National Education Policy 2020 envisions an educational framework that is learner-centric, multidisciplinary, and geared towards fostering creativity, critical thinking, and innovation. It emphasizes the integration of knowledge across disciplines, breaking down traditional silos to encourage holistic understanding and application of concepts. The Bachelor of Science (B. Sc.) curriculum embodies these principles by offering a diverse array of courses spanning various scientific domains, while also incorporating interdisciplinary studies to nurture well-rounded graduates capable of addressing complex challenges with agility and insight.

Furthermore, the curriculum is designed to promote experiential learning, research, and hands-on exploration, recognizing the importance of practical engagement in deepening understanding and cultivating real-world skills. Through laboratory work, field experiences, internships, and project-based learning opportunities, students will have the chance to apply theoretical knowledge in practical settings, develop problem-solving abilities, and cultivate a spirit of inquiry and discovery.

Integral to the National Education Policy 2020 is the commitment to inclusivity, equity, and access to quality education for all. The Bachelor of Science (B. Sc.) curriculum reflects this commitment by embracing diversity in perspectives, backgrounds, and experiences, and by fostering an inclusive learning environment where every student feels valued, supported, and empowered to succeed.

Moreover, the curriculum emphasizes the cultivation of ethical values, social responsibility, and global citizenship, instilling in students a sense of accountability towards society and the environment. By integrating courses on ethics, sustainability, and social sciences, the Bachelor of Science (B. Sc.) program aims to produce graduates who are not only proficient in their respective fields but also compassionate, ethical leaders committed to making a positive impact on the world.

As we embark on this journey of educational transformation guided by the National Education Policy 2020, the Bachelor of Science (B. Sc.) curriculum stands as a testament to our collective vision of a more equitable, inclusive, and enlightened society. It is our hope that through rigorous academics, innovative pedagogy, and unwavering dedication to excellence, we can inspire the next generation of scientists, scholars, and change-makers to realize their full potential and contribute meaningfully to the advancement of knowledge and the betterment of humanity.

Introduction to Undergraduate Degree course in Biotechnology:

As per the recommendations of the NEP-2020, the undergraduate degree course in Biotechnology is a six/ eight semester course spread over three/ four academic years. The teaching – learning process is student-centric and it involves both theory and practical components. It offers a flexibility of programme structure while ensuring that the student gets a strong foundation in the subject and gains in-depth knowledge. Besides the Discipline Specific Core (DSC) courses, a student can opt courses from the syllabus comprising of Discipline Specific Electives (DSEs), Generic Electives (GEs), Skill Enhancement Courses (SECs), Ability Enhancement courses (AECs) and Value Addition Courses (VACs). Thereby, bringing out the multidisciplinary approach and adherence to innovative ways within the curriculum framework. Moreover, it allows a student maximum flexibility in pursuing his/her studies at the undergraduate level to the extent of having the liberty to eventually design the degree with multiple exit options depending upon the needs and aspirations of the student in terms of his/her goals of life, without compromising on the teaching learning, both in qualitative and quantitative terms. This will suit the present day needs of students in terms of securing their paths towards higher studies or employment.

Courses of Study: Courses of the study indicate pursuance of study in a particular discipline. Every discipline shall offer four categories of courses of study, viz. Discipline Specific Core (DSC) courses, Discipline Specific Electives (DSEs), Skill Enhancement Courses (SECs) and Generic Electives (GEs). Besides these four courses, a student will select Ability Enhancement Courses (AECs) and Value-Added Courses (VACs) from the respective pool of courses offered by the University.

a) **Discipline Specific Core (DSC):** Discipline Specific Core is a course of study, which should be pursued by a student as a mandatory requirement of his/ her programme of study. In Bachelor of Science (Hons.) Biotechnology programme, DSCs are the core credit courses of Biotechnology which will be appropriately graded and arranged across the semesters of study, being undertaken by the student, with multiple exit options as per NEP 2020.

b) **Discipline Specific Elective (DSE):** The Discipline Specific Electives (DSEs) are a pool of credit courses of Biotechnology from which a student will choose to study based on his/ her interest.

c) **Generic Elective (GE):** Generic Electives is a pool of courses offered by various disciplines of study (excluding the GEs offered by the parent discipline) which is meant to provide multidisciplinary or interdisciplinary education to students. In case a student opts for DSEs beyond his/ her discipline specific course(s) of study, such DSEs shall be treated as GEs for that student.

d) **Ability Enhancement course (AEC), Skill Enhancement Course (SEC) and Value Addition Course (VAC):** These three courses are a pool of courses offered by

all the Departments in groups of odd and even semesters from which a student can choose.

i. **AEC:** AEC courses are the courses based upon the content that leads to knowledge enhancement through various areas of study. They are based on Language and Literature, and Environmental Science which are mandatory for all disciplines.

ii. **SEC:** SECs are skill-based courses in all disciplines and are aimed at providing hands-on training, competencies, proficiency and skills to students. SEC courses may be chosen from a pool of courses designed to provide skill-based instruction.

iii. **VAC:** VACs are common pool of courses offered by different disciplines and aimed towards personality building, embedding ethical, cultural and constitutional values; promote critical thinking, Indian knowledge systems, scientific temperament, communication skills, creative writing, presentation skills, sports and physical education and team work which will help in all round development of students.

Structure of B. Sc. (Three / Four Years Honours / Honours with Research Degree) Programme with Multiple Entry and Exit Options

Subject (Major): Biotechnology

B.Sc First Year: 1st Semester

Course Type	Course Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major (Core) M1 Mandatory **Biotechnology**	DSC-1	**Biomolecules-I**	2		2		2+2 = 4
	DSC-2	Practical based on DSC-1		4		2	
Major (Core) M2 Mandatory	DSC-1	---	2		2		2+2 = 4
	DSC-2	Practical based on DSC-1		4		2	
Major (Core) M3 Mandatory	DSC-1	----	2		2		2+2 = 4
	DSC-2	Practical based on DSC-1		4		2	
Generic / Open Elective (GE/OE) (Choose any two from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major**	GE/OE-1	To be chosen from other faculty	2		2		2
SEC (Skill Enhancement Courses) (Choose any one from pool of courses)	SEC-1	**i) Microbial cultivation and Identification** ii) **Diagnostic Biology**	1		1		2
	SEC-2	**i) Practicals based on Microbial cultivation and Identification ii) Practicals based on Diagnostic Biology**		2		1	
AEC, VEC, IKS	AEC-1	English (Common for all the faculty)	2		2		2+2 =4
	IKS-1	Choose any one from pool of courses	2		2		
OJT/ FP/CEP/CC/RP	CC-1	Health and Wellness (Common for all the faculty)		4		2	2
			13	**18**	**13**	**09**	**22**

GE/OE-1: **Introduction to Biotechnology** (This course will be available for the students from other faculty)

BSc First Year: 2nd Semester

Course Type	Course Code	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
			Theory	Practical	Theory	Practical	
Major (Core) M1 Mandatory	DSC-3	**Biomolecules-II**	2		2		2+2 = 4
	DSC-4	Practical based on DSC-3		4		2	
Major (Core) M2 Mandatory	DSC-3	-----	2		2		2+2 = 4
	DSC-4	Practical based on DSC-3		4		2	
Major (Core) M3 Mandatory	DSC-3	-----	2		2		2+2 = 4
	DSC-4	Practical based on DSC-3		4		2	
Generic / Open Elective (GE/OE) (Choose any two from pool of courses) **It should be chosen compulsorily from the faculty other than that of Major**	GE/OE-2	To be chosen from other faculty	2		2		2
VSC (Vocational Skill Courses) (Choose any one from pool of courses)	VSC-1	**i) Biofertilizers Production** ii) **Plant Tissue culture**	1		1		2
	VSC-2	**i) Practicals based on Biofertilizers Production ii) Practicals based on Plant Tissue culture**		2		1	
AEC, VEC, IKS	AEC-1	English (Common for all the faculty)	2		2		2+2 =4
	VEC-1	Constitution of India (Common for all the faculty)	2		2		
OJT/ FP/CEP/CC/RP	CC-2	Yoga Education / Sports and Fitness (Common for all the faculty)		4		2	2
			13	**18**	**13**	**09**	**22**
Exit Option : Award of UG Certificate in 3 Majors with 44 credits and an additional 4 credits of core NSQF course / Internship OR continue with Major and Minor							

GE/OE-2 : **Agricultural Biotechnology** (This course will be available for the students from other faculty)

Students will have to choose any three subjects as a **Major 1, Major 2, Major 3,** from Basket 1 under the Faculty of Science and Technology.

Students will be having three subject options of equal credits (instead of Major and / or minor verticals) in the first year. Students will have to select / declare choice of one subject **as a major subject** in the beginning of second year **out of three major options M1, M2 and M3 (Which were opted in the first year).**

Detailed Illustration of Courses included in 1st and 2nd semester:

1) **Major** (Core) subject are mandatory.

DSC-1 : This is a 2 credit theory course corresponding to Major (core) subject

DSC-2 : This is a 2 credit practical course based on DSC-1

DSC-3 : This is a 2 credit theory course corresponding to Major (core) subject

DSC-4 : This is a 2 credit practical course based on DSC-3

2) **Generic / Open Elective (GE/OE)**: (Needs to be chosen (any two) from pool of courses available at respective college). **These courses should be chosen compulsorily from faculty other than that of Major.**

GE/OE -1 : This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.

GE/OE -2 : This is a 2 credit theory course should be chosen compulsorily from faculty other than that of Major.

3) **SEC** (Skill Enhancement Courses) : Choose any one from pool of courses. These courses needs to be designed to enhance the technical skills of the students in specific area.

SEC-1 : This is a 1 credit theory course to enhance the technical skills of the students in specific area.

SEC-2 : This is a 1 credit practical course based on SEC-1.

4) VSC (Vocational Skill Courses) : Choose any one from pool of courses. These courses should be based on Hands on Training corresponding to Major (core) subject.

VSC-1 : This is a 1 credit theory course based Hands on Training corresponding to Major (core) subject.

VSC-2 : This is a 1 credit practical course based on VSC-1

5) **AEC** (Ability Enhancement courses): The focus of these courses should be based on linguistic and communication skills.

AEC-1 : English

This is a 2 credit theory course based on linguistic proficiency. It will be common for all the faculty.

AEC-2 : English

This is a 2 credit theory course based on linguistic proficiency. It will be common for all the faculty.

6) **IKS** (Indian Knowledge System) : The courses related to traditional and ancient culture of India will be included in this section. The respective college will have to choose one of the courses from the pool of courses designed by the University.

IKS-1 : To be chosen from the pool of courses designed by the University

This is a 2 credit theory course based on Indian Knowledge System. It will be common for all the faculty

7) **VEC** (Value Education Courses): The courses such as understanding India, Environmental Science / Education, Digital and Technological solutions etc will be part of Value Education Courses.

VEC-1 : Constitution of India

This is a 2 credit theory course based on value education. It will be common for all the faculty

8) **CC** (Curricular Courses): The courses such as Health and wellness, Yoga education, Sports and Fitness, Cultural activities, NSS/NCC, Preforming Arts.

CC-1 : Health and Wellness

This is a 2 credit practical course based on Co-curricular activities. It will be common for all the faculty

CC-2 : Yoga education / Sports and Fitness

This is a 2 credit practical course based on Co-curricular activities. It will be common for all the faculty

General Guidelines for Course Selection

1) The Major subject is the discipline or course of main focus, bachelors degree shall be awarded in that discipline / subject.
2) Students will have to choose any three subjects as a Major 1, Major 2, Major 3, from **Basket 1** under the Faculty of Science and Technology (based on the available options in the respective college).
3) Students will be having three subject options of equal credits (instead of Major and / or minor verticals) in the first year.
4) In the beginning of second year, students will have to select / declare choice of **one major subject** and **one minor subject** from three major options **M1, M2 and M3(which were opted in the first year)**
5) Once the students finalize their **Major Subject** and **Minor Subject** in the beginning of the second year of the programme, they shall pursue their further education in that particular subject as their **Major and Minor** subjects. Therefore, from second year onwards curriculum of the Major and Minor subjects shall be different.
6) Students are required to select **Minor subject** from **other discipline of the same faculty**
7) Students are required to select **Generic /Open Elective** (vertical 3 in the credit framework) **compulsorily from the faculty different than that of their Major / Minor**

subjects.

8) Vocational Skill Courses and Skill Enhancement Courses (VSC and SEC) shall be related to the Major subject
9) Curriculum of Ability Enhancement Courses (AEC), Value Education Courses (VEC), Indian Knowledge System (IKS), and Co-curricular Courses (CC) will be provided by the University separately.

Programme Educational Objectives (PEOs) :

Programme Educational Objectives (PEOs) for the Bachelor of Science in Biotechnology Curriculum under the National Education Policy 2020:

1. **Mastery of Discipline-Specific Knowledge**: Graduates of the Bachelor of Science program will demonstrate a deep understanding of fundamental principles, theories, and methodologies in their chosen scientific discipline, enabling them to analyze complex problems, propose innovative solutions, and contribute to advancements in their field.

2. **Interdisciplinary Proficiency**: Graduates will possess the ability to integrate knowledge and skills from multiple scientific disciplines, fostering a holistic approach to problem-solving and innovation. They will be equipped to address multifaceted challenges by drawing upon diverse perspectives and methodologies.

3. **Critical Thinking and Analytical Skills:** Graduates will develop strong critical thinking abilities, enabling them to evaluate information rigorously, analyze data effectively, and make informed decisions based on evidence. They will demonstrate proficiency in applying logical reasoning and scientific methods to solve problems and generate new knowledge.

4. **Leadership and Innovation:** Graduates will demonstrate leadership qualities and entrepreneurial mindset, capable of initiating and driving positive change in their organizations and communities. They will exhibit creativity, resilience, and adaptability, harnessing innovation to address complex challenges and seize opportunities for growth and advancement.

5. **Global Citizenship and Cultural Sensitivity**: Graduates will possess a global perspective and cultural sensitivity, recognizing the inter connectedness of diverse communities and the importance of collaboration across borders. They will engage in cross-cultural dialogue, embrace diversity, and contribute to the advancement of knowledge and understanding on a global scale.

These Programme Educational Objectives serve as guiding principles for the Bachelor of Science curriculum, reflecting our commitment to nurturing well-rounded graduates who are prepared to excel in their careers, contribute to society, and lead meaningful lives in a rapidly changing world.

Programme Outcomes (POs) :

The National Education Policy (NEP) 2020 for India emphasizes several key aspects for Bachelor of Science (B.Sc.) programs, aiming to produce graduates who are not only well-versed in their respective disciplines but also equipped with skills necessary for holistic development and employability. While specific program outcomes may vary between institutions and disciplines within B.Sc. programs, here are some common outcomes aligned with NEP 2020:

- **PO1.The citizenship and society:** Apply broad understanding of ethical and professional skill in science subjects in the context of global, economic, environmental and societal realities while encompassing relevant contemporary issues.

- **PO2.Environment and sustainability**: Apply broad understanding of impact of science subjects in a global, economic, environmental and societal context and demonstrate the knowledge of, and need for sustainable development.

- **PO3.Ethics:** Apply ability to develop sustainable practical solutions for science subject related problems within positive professional and ethical boundaries.

- **PO4.Individual and team work:** Function effectively as a leader and as well as team member in diverse/ multidisciplinary environments.

- **PO5.Communication:** Communicate effectively on complex science subject related activities with the scientific community in particular and with the society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

- **PO6.Project management and finance**: Demonstrate knowledge and understanding of the first principles of science and apply these to one's own work as a member and leader in a team, to complete project in any environment.

- **PO7.Life-long learning**: Recognize the need for lifelong learning and have the ability to engage in independent and life-long learning in the broadest context of technological change.

These program outcomes align with the broader goals of NEP 2020 to transform higher education in India and prepare students for the challenges and opportunities of the 21st century. Board of Studies designing B.Sc. curricula are encouraged to incorporate these outcomes into their program objectives and learning outcomes.

Programme Specific Outcomes (PSOs):

On completion of the 03/ 04 years Degree in B.Sc. (Biotechnology) **students will be able to:**

- **PSO 1.Disciplinary Knowledge:** Bachelor degree in Biotechnology is the culmination of in-depth knowledge of Biotechnology, Molecular Biology, R- DNA technology, Genetics, Biochemical mechanism, Plant animal tissue culture, and several other branches of Biotechnology. This also leads to study the related areas. By acquiring this sound knowledge in the subject, Graduate in Biotechnology can be eligible for pursuing higher education and research / postgraduate education.
- **PSO 2.Specialized skill:**Students will gain knowledge and develop specialized skill in the different area of Biotechnology. Graduate candidates will develop a sense of societal and ethical responsibility pertaining to bioinformatics, health, agriculture, dairy, genetic engineering, and fermentation industry.
- **PSO 4. Knowledge about research/thirst area in Biotechnology:**The graduated student in Biotechnology will develop understanding about various research domains in Biotechnology field.
- **PSO 5.Information/digital Literacy:** The completion of this programme will enable the learner to use not only the fundamental tools Biotechnology but also its domainslike Bioinformatics and Biostatics.
- **PSO 6.**This knowledge shall promote our graduates to stand independently amidst the growing technological innovations in the subject.
- **PSO7** The students completing this programme will develop ability of working independently and to make an in-depth study of various domains of Biotechnology.

Semester – I

DSC-1 : (Biomolecules-I)

Total Credits : 02 Total Contact Hours : 30 Hrs
Maximum Marks : 50

Learning Objectives of the Course:

i. To acquaint the students with general introduction to the basic concepts of Biochemistry of different Biomolecules.
ii. Toinculcatetheknowledgeondifferenttypesofcarbohydratesandtheirstructure.
iii. Toaddtheknowledgeonthestructureandtypesofaminoacids,proteinsandtheirorganization.
iv. Toimpartthefundamentalknowledgeaboutlipids,theirtypesandDNA,RNA.

Course Outcomes (COs) :

After completion of the course, students will -

i. Gain knowledge about the chemical and molecular foundations of life and the role of energy rich compound in biological systems.
ii. understandtheroleofsugarsinenergyproductionandlivingsystems
iii. Be able to Applythelink betweenthestructureandfunctionsofproteinsinbiologicalcontext
iv. Analyzetheroleoflipdsand applythetechniquesto identifytheirpurity

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**Carbohydrates** GeneralclassificationofCarbohydrates,StructuralClassificationofMonosaccharides,aldoses and ketoses, Ringformation in Monosaccharides, Mutarotation, Oligosaccharide Glycosidic bond, Disaccharides(Sucrose, Maltose, Lactose) Polysaccharides (e.g. Starch, Glycogen, Cellulose, Heparin, Pectin),Biological functions of Carbohydrates. Molecules involved in generation of Mechanical Stability:Peptidoglycan, Polysaccharide (Cellulose in Plant).	**10 Hrs**
II	**Aminoacid&Protein** Aminoacid&Protein:Structuralclassificationofaminoacidsbasedon Rsidechain,Structural levels of Proteins,Classification ofProteinsbasedonComposition,Functions ofProteins. Introduction to Enzyme.	**10 Hrs**

III	**Lipids** Classification, Function of lipids, Fatty acids: (physical and chemical properties, Nomenclature, Even and odd carbon, Saturated, unsaturated). essential fatty acids, Triacylglycerols, Phospholipids, Glycerophospholipids, glycolipids, spingolipids lipoproteins, steroids, Cholesterol, Ergosteril, Membrane lipids: Ampipathic lipids.	**10 Hrs**

TextBooks:

- Physical Biochemistry: Applications to Biochemistry and Molecular Biology, David, M. Freifelder, ACS publication, 1983.
- Agarwal, G. R. Agarwal K., Agarwal O. P. (2005) Text Book of Biochemistry, 13thedn., Goel Publishing House, Krishna Prakashan Media Pvt. Ltd., Meerut, India.
- Jain, J.L., Jain,S. and Jain,N. (2005) Fundamentals of Biochemistry, 6th edn., S. Chand and Company Ltd., Delh

ReferenceBooks:

- Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006) Biochemistry, VI Edition, W.HFreeman and Co.
- Buchanan, B., Gruissem, W. and Jones, R. (2000) Biochemistry and Molecular Biology of Plants, American Society of Plant Biologists.
- Nelson, D.L., Cox, M.M. (2004) Lehningers' Principles of Biochemistry, 4th Edition, WH Freeman and Company, New York, USA.
- □ Hopkins, W.G. and Huner, P.A. (2008) Introduction to Plant Physiology, John Wiley and Sons, Salisbury, F.B. and Ross, C.W. (1991) Plant PhysiologyWadsworthPublishing Co. Ltd.
- □ Satyanarayana, U. and Chakrapani U. (2010) Biochemistry, Books and Allied Pvt. Ltd., Kolkata, India.

DSC-2 : Lab Course-I (Based on DSC-1)	
Total Credits : 02 Maximum Marks : 50	Total Contact Hours : 60 Hrs
Course Objectives	● To acquaint students with various techniques used like extraction, detection, estimation and separation ● To develop skill-full hand of the students
Course Outcome	**After successful completion of this course, students are expected to:**□ ◆ perform qualitative tests for carbohydrates, lipids and amino acids ◆ extract carbohydrate and proteins ◆ estimation carbohydrates, lipids and proteins
1.	Estimationof glucose byDNSA method.
2.	Qualitative tests for carbohydrates
3.	Isolationand detectin ofstarchfrompotatoes/maize/wheat.
4.	Qualitative tests for amino acids
5.	Estimation of amino acid byninhydrin method.
6.	Estimation of protein by Biuret method & Lowry method.
7.	Estimation of Acid value of given oil sample
8.	Estimation of Saponification value of given oil sample
9.	EstimationofDNAbyDPAmethod
10.	EstimationofRNAbyOrcinolMethod
11.	Qualitative tests for lipids
12.	Qualitative test for amylase
13.	Extraction and detection of Casein from milk

Text Books:

- Jayaraman, J. (2011). Laboratory Manual in Biochemistry, New Age International (P) Ltd. Publishers, New Delhi.
- □ Sadashivam, S. and Manikam, A. (2018). Biochemical Methods, 3rdedition, New Age International (P) Ltd. Publishers, New Delhi.

Reference Books:

- Wilson, K. and Walker, J. (2003). Practical Biochemistry: Principles and techniques, 5thedition, Cambridge University Press, UK.
- Plummer, D. T. (2017). An Introduction to Practical Biochemistry, 3rd edition, TataMcGraw Hill Publishing Company Ltd., New Delhi.
- Oser, B. L. (ed.) (1965). Hawk's physiological chemistry, 14thedition, McGraw-HillBook Company, New York, USA
- Rao, B. S. and Deshpande, V. (2005). Experimental Biochemistry: A student companion, I. K. International Pvt. Ltd., New Delhi.

SEC1:Microbial cultivation and Identification

Total Credits : 01 Total Contact Hours : 15 Hrs
Maximum Marks : 50

Learning Objectives of the Course:

1) ToprovidebasicunderstandingofMicrobiologyandrelatedconcept.
2) TomakestudentawareofvariousTechniquesinMicrobiology.
3) Todemonstratepractical utilityof themicrobial world.

Course Outcomes (COs) :
After completion of the course, students will be able to -

1) UnderstandandexplainimportanceofMicrobialworld.
2) StudentswilluseidentificationtechniquesformicrobialStudy.
3) AwarenessofPracticaladvancesinCultureidentification.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**MicroorganismsanditsCultivation** Microbiology-Introduction, History in brief, Microorganism and its types, Pure culture & Staining technique, Microscopy in brief. Microbial Nutrition: Common nutrient requirements, Nutritional types of microorganisms, growth factors. Uptake of nutrients by cells. Culture Media: Synthetic or defined media. Commonly used media. Types of Media- Selective, differential and enrichment media. Aseptic Techniques: Disinfection, Sterilization. Cultivation of fungi, actinomycetes, yeasts, algae and photosynthetic bacteria. Pure culture: Concept of pure culture. Methods of pure culture of microorganisms — Spread plate, streak plate and pour plate.	**08 Hrs**
II	**Microbial identification** Bacterial Identification: IntroductionandOverview(inbrief). Morphologicalandculturalcharacteristics in detail.	**07 Hrs**

	Biochemicalidentification:IMVIC,Sugarfermentation,Enzymetest. AdvanceMoleculartechniquesfor bacterialidentification(in brief about 16s rDNA, Metagenomics for consortium identification).	
TextBooks: 1. Textbook of Microbiology by Ananthanarayan and Panikers tenth edition, University press. 2. MicrobiologybyMicael J. Pelczer. 5th edition Tata McGraw-Hill publisher,		
ReferenceBooks: 1. GeneralMicrobiologybyStenierR.Y.*etal* Mcmillanpress.Inc. 2. Fundamentals Principles ofBacteriologybySalle A.J.McGrw-HILL BOOK COMPANY, INC. NEW YORK AND LONDON.		

SEC2: Diagnostic Biology

Total Credits : 01 Total Contact Hours : 15 Hrs
Maximum Marks : 50

Learning Objectives of the Course:

- To acquaint the students with the practical applications of molecular diagnostics in theclinical laboratory. Students will learn to perform technical molecular biology assays onproteins, DNA, RNA that can be used in the diagnosis of human diseases.

Outcomes of course

On the completion of the course, the student should be able to:

- Understand the difference between Quality Control and Quality Assurance in the molecular laboratory
- Understand the importance of good pipetting techniques
- Understand and perform simple and serial dilutions
- Describe methods for quantification of nucleic acids
- Report results for molecular testing
- Follow a protocol to perform testing
- Understand the use and purpose for isolating DNA, RNA and proteins 8. Explain the
- principle of electrophoresis as it applies to nucleic acids and proteins

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**Unit I: Blood Analysis**: Blood Typing, Types of Blood groups, rare blood groups, Importance of Blood grouping. Differential WBC Count, Types of WBC, Biological role of Leucocytes, Significance of different parameters tested in Complete Blood Count (CBC). Biological role of Hemoglobin, Normal level, significance of test. **Antigen-Antibody reactions in diagnosis**: Widal test; Introduction to Typhoid , causative agent, Symptoms, Test for diagnosis for Enteric fever, Widal test types, Procedure and interpretation. ELISA: Types, ELISA as tool in clinical Biology.	**08 Hrs**
II	**Microbiological analysis:** Introduction, Microbial culture methods (from biological samples), Biochemical tests for diagnosis of enteric pathogens, Interpretation of tests plates. Antibiotic sensitivity test:	**07 Hrs**

	Introduction, different types of antibiotics, mode of action. Blood Sugar, Dietary Sources, hyperglycemia, hypoglycemia, Estimation, Clinical significance	
References 1. F. C. Hay, M. R. Olwyn, P. N. Westwood and N. L. Hudson, Practical Immunology, 4th ed. UK: Blackwell Company Ltd, 2002. 2. G. P. Talwar, Hand Book of Practical and Clinical Immunology, 2nd ed. Vol. II, New Delhi: CBS Publishers and Distributors, 2009.		

SEC-2 : Lab Course - Based on SEC-1 (i)

Total Credits : 01 Total Contact Hours : 30 Hrs
Maximum Marks : 50

Learning Objectives of the Course:

- To make students familiar with the microbial isolation cultivation techniques.
- To make students familiar with the microbial identification techniques.
- To make student aware about safety measures while handling microrganisms.

Course Outcomes (COs) :

After completion of the course, students will be able to -

i) Student will gain knowledge about microbial isolation cultivation techniques.
ii) Student will gain knowledge about microbial identification techniques.
iii) Student will gain knowledge aboutsafety measures while handling microrganism

Practical No./ ModuleNo.	Topics / actual contents of the syllabus
1.	Demonstrationofworkingandprinciplesofbasicinstrumentsin MicrobiologyLaboratory.
2.	Operationandhandlingof LaminarAirflowsystem
3.	DemonstrationofPreparationofculturemedia forgrowth
4.	IsolationofMicroorganisms (bacteriaandfungus)usingpureculturetechniques.
5.	EffectoftemperatureandpHonbacterial growth.
6.	TMicroscopicobservationofMicroorganismsandstainingtechniques.
7.	BiochemicalcharacterizationofMicroorganismsusingIMVICtest
8.	Biochemical IdentificationusingSugarfermentationtest
9.	EnnzymetestforIdentification:Catalase,Starchhydrolysis.

TextBooks:

1.B.S. Vatsa and Suchi Vatsa,"Discrete Mathematics," Fourth Revised Edition, New Age International Publishers, (2009)...

ReferenceBooks:

1.Swapan Kumar Sarkar," A Textbook of Discrete Mathematics," Ninth edition 2016, S. Chand, (Reprint 2021).
2. Kenneth H. Rosen," Discrete Mathematics and its Applications," Seventh Edition, McGraw-Hill Book Company
3. Krishnamurthy V., "Combinatorics, Theory and Applications," East-West Press, 2008.
4. Brualdi R.A,"Introductory Combinatorics," 5th Edition, Pearson Education Inc., 2009.

SEC-2 : Lab Course - Based on SEC-1 (ii)

Total Credits : 01 Total Contact Hours : 30 Hrs
Maximum Marks : 50

Learning Objectives of the Course:

- To make students familiar diagnostics techniques in theclinical laboratory.
- To make students familiar with the microbial identification techniques.
- To make student aware about safety measures while handling microrganisms.

Course Outcomes (COs) :

After completion of the course, students will be able to -

Students will learn to perform technical molecular biology assays onproteins, DNA, RNA that can be used in the diagnosis of human diseases.

Practical No./ ModuleNo.	Topics / actual contents of the syllabus
1	Antigen – Antibody reactions- Agglutination (Blood grouping testing).
2.	Blood cell counting (Both RBC and WBC)
3	Estimation of blood groups
4	Estimation of hemoglobin.
5	WIDAL test.
6	Antibiotic sensitivity test.
7	Estimation of Blood Sugar
8	Biochemical IdentificationusingSugarfermentationtest

References

- F. C. Hay, M. R. Olwyn, P. N. Westwood and N. L. Hudson, Practical Immunology, 4th ed. UK: Blackwell Company Ltd, 2002.

- G. P. Talwar, Hand Book of Practical and Clinical Immunology, 2nd ed. Vol. II, New Delhi: CBS Publishers and Distributors, 2009.

This course will be available for the students from other faculty

GE/OE-1 :Introduction to Biotechnology

Credits : 02 Total Contact Hours : 30 Hrs
mum Marks : 50

ning Objectives of the Course:

- Tounderstandthestudentstodifferentbasicprocessesandbasictechniquesusedin Biotechnology.
- Tointroducestudentswith different applicationsof Biotechnologyineverydaylife.
- Developan interest in students to studyBiotechnologyasadiscipline.

se Outcomes (COs) :

completion of the course, students will be able to -

- Understandfundamentalprinciplesinvolvedin Biotechnology
- Tobestowthestudentswith allthe researchskills requiredtowork independently
- To inculcate naturecare byimpartingknowledgeof advancemodern techniques.

uleNo.	Topics / actual contents of the syllabus	Co Ho
I	**UnitI-Basicconceptof Biotechnology** Definition, Scope & importance of Biotechnology, Prokaryotic & Eukaryotic cell-Cell wall,DistinctionbetweenProkaryotic&Eukaryoticcell,cellorganelle,Cellmembrane,Cytoplasm,nucleoid. Culture Media: Synthetic or defined media. Types of Media- Selective, differentialand enrichment media. Pure culture: Concept & Methods of pure culture microorganisms –Spreadplate, streak plateand pourplate.	10
II	**UnitII-Branches ofBiotechnology** Agricultural biotechnology, Environmental biotechnology, Medical biotechnology, Aqua/Marine Biotechnology, Industrial biotechnology, biotechnology and IPR, biotechnology in Food and nutrition, Traditional and Modern Biotechnology.	10
II	**UnitIII-Applications of Biotechnology** Biotechnology in Food Production, Pharmaceutical Biotechnology- Recombinant Insulin,Vaccines,Genetherapy, stem cell therapy,Plant & Agriculture Biotechnology- GM Food (GMTomato) Fungal and Insect Resistant Plants, BT Cotton, , Modifications inPlantQuality, Golden Rice,Plant Tissueculture, EnvironmentalBiotechnology-Biodegradation,Bioremediation.	10

ferenceBooks:

1. BiotechenologybyU. Satyanarayan
2. AlanWiseman,Principles ofBiotechnology, SurreyUniversitypress,1983.
3. PlantBiotechnology- K.G.RamavatS.ChandPublications
4. ExperimentsinPlanttissueculture-DoddsandRoberts-Cambridge UniversityPress.
5. Biotechnology:EnvironmentalProcesses-Rehmand Reed-Wiley
6. 6..MolecularBiotechnology- GlickandPastermanASMPress
7. Theworldofthecell,Becker,Kleinsmith,Hardin.Cellbiology- C.B.Powar
8. AnIntroductiontoBiotechnologythesciencetechnologyandMedicalapplication,Godbey,W. T, Woodhead Publishing
9. BiotechnologybyB.D.Singh.
10. EnvironmentalBiotechnologyyS.N. Jogadnad

Semester – II

DSC-3 : (Biomolecules -II)

Total Credits : 02 Total Contact Hours : 30 Hrs
Maximum Marks : 50

Learning Objectives of the Course:

1. To acquaint students with chemistry of biomolecules
2. To make students understand the importance of biomolecules in life

Course Outcomes (COs) :

After completion of the course, students will be able to -

i) Concept of DNA and RNA
ii) Different types and importance of vitamins human
iii)Functions of different hormones

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**Nucleic acids:** ◆ Definition and types of nucleic acid-DNA and RNA ◆ Structural Components of Nucleic acids: phosphoric acid, pentose sugar, nitrogenous bases - purines and pyrimidine ◆ Nucleosides and Nucleotides DNA structure (Watson and Crick Model,A, B and Z form of DNA ◆ Chargaff's Rule, ◆ Denaturation of DNA: definition and its effect on UV absorption, viscosity, and specific optical rotation. ◆ Effect of pH and temperature on DNA denaturation, ◆ Renaturation of DNA. ◆ RNA: Structure and Significance of: mRNA, tRNA and rRNA.	**10 Hrs**
II	**Vitamins** Classification, fat soluble (A,D,E,K), Metabolism and Biochemical functions, Recommended dietary Allowance (RDA), Deficiency symptoms Fat insoluble, (C, B12, Complex) Metabolism and Biochemical functions,	**10 Hrs**

	Recommended dietary Allowance, Vitamin like compounds.	
III	**Unit 3: Hormones** Classification : based on Chemical nature, based on mechanism of action: group I and II hormones. Hypothalamic hormones , Anterior pitutary hormones, growth hormones, abnormalities in it production, posteior pitutary hormones, Thyroid hormones: Biochemical functions, Androgens, estrogens, progesteros	**10 Hrs**
Reerences: ● U. Satyanarayana and U. Chakrapani (2007) 'Biochemistry' Third edition, Books and Allied (P) Ltd. ● Berg, J. M., Tymoczko, J. L., Gatto, G. J. (2019). Biochemistry (9th ed.). W. H. Freeman. ● This comprehensive biochemistry textbook covers biomolecules and their relevance in biological processes. ● Nelson, D. L., Cox, M. M. (2019). Lehninger Principles of Biochemistry (7th ed.). W. H. Freeman.		

DSC-2 : Lab Course-I (Based on DSC-1)	
Total Credits : 02 Maximum Marks : 50	Total Contact Hours : 60 Hrs
Course Objectives	● To acquaint students with various techniques used like extraction, detection, estimation and separation ● To develop skill-full hand of the students
Course Outcome	**After successful completion of this course, students are expected to:**□ ◆ perform qualitative tests for nucleic acids, Vitamins and hormones, ◆ perform quantitative tests for nucleic acids, Vitamins and hormones, ◆ Perform purity test of biomolecules
1	Quantitative determination of DNA by spectrophotometric method and its purity check
2	Quantitative determination of RNA by spectrophotometric method and its purity check
3	Thermal denaturation of DNA
4	Estimation of DNA by DPA method
5	Estimation of RNA by Orcinol method
6	Simple assays for vitamins and hormones
7	Estimation of ascorbic acid from natural sources

Text Books:

- Jayaraman, J. (2011). Laboratory Manual in Biochemistry, New Age International (P) Ltd. Publishers, New Delhi.
- □ Sadashivam, S. and Manikam, A. (2018). Biochemical Methods, 3rdedition, New Age International (P) Ltd. Publishers, New Delhi.

Reference Books:

- Wilson, K. and Walker, J. (2003). Practical Biochemistry: Principles and techniques, 5thedition, Cambridge University Press, UK.
- Plummer, D. T. (2017). An Introduction to Practical Biochemistry, 3rd edition, TataMcGraw Hill Publishing Company Ltd., New Delhi.
- Oser, B. L. (ed.) (1965). Hawk's physiological chemistry, 14thedition, McGraw-

HillBook Company, New York, USA

- Rao, B. S. and Deshpande, V. (2005). Experimental Biochemistry: A student companion, I. K. International Pvt. Ltd., New Delhi.

VSC-1 : (i)Bio-fertilizer production

Total Credits : 01 Total Contact Hours : 15 Hrs
Maximum Marks : 50

Learning Objectives of the Course:

- Tomakethestudentstounderstandroleofbiofertilizersanditsmechanismofactioninagriculture.
- Tomakethestudentsunderstandthebasic principlesofproductionofdifferentbiofertilizersas per need ofagriculture.
- Toteachisolation,characterization,massinoculumproductionandfieldapplicationofbiofertilizers.

Course Outcomes (COs) :

After completion of the course, students will be able to -

- Understandadvantagesofbiofertilizersoverchemicalfertilizers.
- Explainisolationandroleofvarious soilbacteriainbiofertilizer production.
- Describeproductionstepsandspecific requirementsforeachbiofertilizer.

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**Unit 1**:- Introduction and types of fertilizers, chemical fertilizers, bio fertilizers, Comparisonbetween Chemical and bio fertilizers, Applications, General account about the microbes used asbio fertilizer-Nitrogen and phosphate solubilizers (in brief) *Rhizobium*- isolation, identification,massmultiplication, andcarrier basedinoculant.IAAproducingmicroorganisms.	**08Hrs**
II	**Unit2:-***Azotobacter*-classification,characteristics-cropresponsetoazotobacterinoculum,maintenanceandmassproduction.Cyanobacteria(bluegreenalgae),Azollaandanabenaassociation. Phosphatesolubilizingmicrobes(anyone)-isolation,characterization,massinoculumproduction.Potassiumsolubilizingbacteria-isolation and characterization.	**07 Hrs**

Reference Books:

1) BiotechnologyKumaresan,V.(2005)SarasPublications,NewDelhi.
2) BiotechnologyofBiofertilizersKanniyan,S.,920030,CHIPS,Texas.
3) SoilMicrobiologySubha Rao,N.S.(2000),Oxford&IBHPublishers,NewDelhi.
4) ATextbookofBiotechnology-Dubey,R.C.,(2005) S.Chand&Co,New Delhi.
5) HandbookofMicrobilBiofertilizersRai,M.K.,(2005),TheHaworthPress,Inc.NewYork .

VSC-1 : ii) Plant tissue culture

Total Credits : 01 Total Contact Hours : 15 Hrs
Maximum Marks : 50

Learning Objectives of the Course:

1. **To** grasp the fundamental principles of plant tissue culture, including cell physiology, growth, differentiation, and regeneration.
2. **Student should** proficient in the techniques involved in plant tissue culture, such as sterilization methods, explant preparation, media preparation, culture initiation, subculture, and maintenance , importance of aseptic techniques to prevent contamination.
3. **Exploring Different Culture Systems**: Students should be exposed to various culture systems used in plant tissue culture, such as organ culture, cell suspension culture, embryo culture, meristem culture, and protoplast culture. They should understand the applications and advantages of each system

Course Outcomes (COs) :

After completion of the course, students will be able to -

understand the fundamental principles of plant tissue culture

Will gain skills for PTC techniqoe.

Will gain knowledge of various plant organ culture systems

ModuleNo.	Topics / actual contents of the syllabus	Contact Hours
I	**Unit 1:** Basics - Totipotency, Competency, Determinism, Requirements of tissueculture facilities, Surface sterilization of materials, Basic procedure for AsepticTissuetransfer,Culturemedia,Compositionofmedia,Phytohormones,mediacomponents (Vitamins, Unidentified supplements, Carbohydrate for energy source,Nitrogensourceandorganicsupplements,Complexsubstances,Activatedcharcoal)Anappraisalofdifferentmedia,Hormones:Auxins,Cytokinins,Gibberellins,Abscisicacid,Ethylene.	08**Hrs**

II	**Unit2:** Tissueculture production of **Commercial Crops:** **Agricultural**–Banana-CollectionofSuckers,Disinfectionofpropagule,inoculation & maintenance of shoots, rooting, hardening; Pomegranate - Collectionofstemexplants,Disinfection,inoculation&maintenanceofshoots,rooting,hardening; **Ornamental**–Gerbera-Plantmaterialandexplantpreparation,Cultureestablishment,Shootregeneration,Acclimatizationandtransferofplantletstosoil; **Medicinalplants**–Tulsi(*OcimumSanctum*)-GerminationofSeeds,PlantMaterialandCultureEstablishment,RootingandPlantletDevelopment,GreenhouseAcclimatization	**07 Hrs**

References:

- Plant Tissue Culture: Theory and Practice, S.S. Bhojwani, M.K. Razdan - Elsevier Science.
- Damasco, O.P. 2005. Tissue culture of banana. pp. 59-62. In: F.S. dela Cruz et al. (eds). Towards management of Musa nematodes in Asia and the Pacific. International Plant Genetic Resources Institute (INIBAP), Laguna, Philippines.
- Perez, E.A. and C.R.R. Hooks. 2008. Preparing tissue-cultured banana plantlets for field planting. CTAHR Cooperative Extension Service Publication. BIO-8. 3 pp
- H. S. Chawla. 2018. Introduction to Plant Biotechnology, CBS Publishers &Distributors
- U Satyanarayana. 2020. Biotechnology, Publisher - Books & Allied Ltd.

VSC-2Lab Course - Based onVSC-1 (i)

Total Credits : 01 Total Contact Hours : 30 Hrs
Maximum Marks : 50

Learning Objectives of the Course:

- To acquire knowledge on biofertilizer preparation
- To gain knowledge about isolation of cyanobacteria
- To develop skill for isolation of soil microflora

Course Outcomes (COs) :
After completion of the course, students will be able to -

i) Understand the mechanism ofe biofertilizer preperation.
ii) Isolate cyanobacteria
iii) Isolate Nitrogen fixing and phsphate solubilizing microbes.

Practical No. ModuleNo.	Topics / actual contents of the syllabus
I	Isolationand characterizationof*Rhizobium*
II	Productionofliquidand solidbiofertilizersfrom*Rhizobium*
III	Isolationand characterizationof*Azospirillum&Azotobacter.*
IV	Productionofliquidand solidbiofertilizersfrom *Azospirillum&Azotobacter.*
V	IsolationandCharacterizationofcyanobacteriafromwaterbodies.
VI	ProductionofCyanobacteriabasedflakes.
VII	IsolationandCharacterizationofPSMfromsoil.
VIII	Isolation of IAA producers and production of IAA based biofertilizers.
IX	ProductionofliquidandsolidbiofertilizersfromPhosphatesolubilizingmicroorganisms
X	IndustrialvisittoBiofertilizerproductionplant

References;

- BiotechnologyKumaresan,V.(2005)SarasPublications,NewDelhi.
- BiotechnologyofBiofertilizersKanniyan,S.,920030,CHIPS,Texas.
- SoilMicrobiologySubha Rao,N.S.(2000),Oxford&IBHPublishers,NewDelhi.

- ATextbookofBiotechnology-Dubey,R.C.,(2005) S.Chand&Co,New Delhi.
- HandbookofMicrobilBiofertilizersRai,M.K.,(2005),TheHaworthPress,Inc.NewYork.

VSC-2 Lab Course - Based onVSC-1 (ii)

Total Credits : 01 Total Contact Hours : 30 Hrs
Maximum Marks : 50

Course Objectives :

1. **To** grasp the fundamental principles of plant tissue culture, including cell physiology, growth, differentiation, and regeneration.
2. **Student should** proficient in the techniques involved in plant tissue culture, such as sterilization methods, explant preparation, media preparation, culture initiation, and subculture, and maintenance, importance of aseptic techniques to prevent contamination.
3. **Exploring Different Culture Systems**: Students should be exposed to various culture systems used in plant tissue culture, such as organ culture, cell suspension culture, embryo culture, meristem culture, and protoplast culture. They should understand the applications and advantages of each system

Course Outcomes (COs) :

After completion of the course, students will be able to -

- understand the fundamental principles of plant tissue culture
- gain skills for PTC technique.
- gain knowledge of various plant organ culture systems.

Practical No. ModuleNo.	Topics / actual contents of the syllabus
I	Preparation,storageofPhytohormonesandnutrientstocks
II	Plant Regeneration from callus.
III	Anther culture
IV	Preparation of artificial seed
V	Isolation of protoplas

VI	MicropropagationofTulsi
VII	Planttissueculturemediapreparation andsterilization.
VIII	MicropropagationofBanana
IX	MicropropagationofGerbera

References:

- Plant Tissue Culture: Theory and Practice, S.S. Bhojwani, M.K. Razdan - Elsevier Science.
- Damasco, O.P. 2005. Tissue culture of banana. pp. 59-62. In: F.S. dela Cruz et al. (eds). Towards management of Musa nematodes in Asia and the Pacific. International Plant Genetic Resources Institute (INIBAP), Laguna, Philippines.
- Perez, E.A. and C.R.R. Hooks. 2008. Preparing tissue-cultured banana plantlets for field planting. CTAHR Cooperative Extension Service Publication. BIO-8. 3 pp
- H. S. Chawla. 2018. Introduction to Plant Biotechnology, CBS Publishers &Distributors
- U Satyanarayana. 2020. Biotechnology, Publisher - Books & Allied Ltd.

This course will be availa

GE/OE-2 : A

Total Credits : 02 Total Contact Hours : 30 Hrs
Maximum Marks : 50

Learning CourseObjectives

- Tounderstandsoil microflora &biofertilizers.
- Getknowledgeaboutplanttissueculturing.
- Toimpartknowledgeofplantdiseaseandgeneticmodificationinplants.

Courseoutcomes

- Studentgetknowledgeaboutalltypesofbiofertilizers
- Studentwouldbeaware of planttissueculturetechniques
- Studentwould know thebasics ofplant pathologyand its geneticmodification.

oduleNo.	Topics / actı
I	**Unit:1IntroductiontoBiofertilizerandMicroorganism** Vermicompostiong, Phosphate cycle, Nitrogen cycle, Nitrogen fixing bac application,Azospirillum,Azotobacter,Cyanobacteria, Mycorrihza (Endo and Exo).
II	**Unit:2PlantTissueculture** Introductiontocellandtissueculture,tissueculturemedia:compositionandpreparation, ofcallusandsuspensionculture,singlecellclones,organogenesis:principle,conceptandapplicationso us lines.Cryopreservation,slowgrowthandDNAbankingforgermplasmconservation.
III	**Unit:3Plantpathology&andGeneticallymodifiedplants** Brief account of algal, fungal, bacterial disease. Mode of entry of pathogen DiseasecausedbyMycoplasmaandnematode Stepsinvolvedinforminggeneticallymodifiedplants,ExamplesofGMcrops(BTcotton,Goldenrice

References

1. Bagyaraj.D.JandA.Manjunath1990. Mycorrhizalsymbiosis.
2. Purohit S.S ,P.R. Kothari , S.K Mathur Basic and Agricultural BiotechnologySubbaRao,N.S 199
3. CookR.J.andBaker K.F.1983The nature andpracticeof biologicalcontrolofplantpathology
4. Biotechnology,AtextbookofindustrialMicrobiologybyCreugerandCreuger, Sinaeurassociates.

5. GeneticsandBiotechnologyofIndustrialMicroorganismsby
6. C.l.Hershnergey,S.W.QueenerandQ.Hegeman.Publisher.
ΛSM.EwesisET.Λl1998.BioremediationPrinciples.MacGrawHill

Basket 1: List of Major subjects in Science (DSC)

Students willing to pursue their bachelors in the **Faculty of Science and Technology** shall choose any three subjects (from the following options) as Major 1, Major 2 and Major 3 (Based on the available options in the respective college)

Semester	Sr No	BOS / Ad hoc Board proposing the course	Title of the Corse
1st and 2nd Semester *(Students shall choose any three subjects (from these options) as Major 1, Major 2 and Major 3 (Based on the available options in the respective college)*	1	BOS in Botany	Botany
	2	BOS in Chemistry	Chemistry
			Analytical Chemistry
			Polymer Chemistry
	3	BOS in Biotechnology	Biotechnology
	4	BOS in Physics	Physics
			Non-Conventional and Conventional Energy
			Instrumentation Practice
	5	BOS in Zoology	Zoology
	6	BOS in Electronics	Electronics
	7	BOS in Fishery Science	Fishery Science
	8	BOS in Microbiology	Microbiology
	9	Ad Hoc Board in Statistics	Statistics
	10	Ad hoc Board in Industrial Chemistry	Industrial Chemistry
	11	Ad hoc Board in Dairy Science& Technology	Dairy Science & Technology
	12	Ad hoc Board in Biotechnology and Bioinformatics	Biotechnology
			Bioinformatics
	13	Ad hoc Board in Biochemistry	Biochemistry
	14	Ad hoc Board in Home Science	Home Science
	15	Ad Hoc Board in Agrochemical Fertilizers, Horticulture, Dry land Agriculture	Agrochemical Fertilizers
			Horticulture
	16	Ad hoc Board in Forensic Science	Forensic Science
			Forensic Science & Cyber Security
	17	Ad Hoc Board in Computer Science	Computer Science
			Computer Application
			Information Technology
			Data Science
	18	Ad Hoc Board in Networking and Multimedia	Networking and Multimedia
	19	Ad Hoc Board in Environmental Science	Environmental Science
	20	BOS in Fishery Science	Fishery Science
	21	Ad hoc Board in Automobile Technology / Workshop Technology / Refrigerator and Air Conditioning	Automobile Technology
			Workshop Technology
			Refrigerator and Air

			Conditioning
	22	Ad hoc Board in Geology	Geology

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